

***DRAFT***

SYSTEM SPECIFICATION – SMALL UNIT RIVERINE CRAFT

APPENDIX A

## **CRAFT TESTS AND TRIALS**

**DRAFT**

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A  
***DRAFT***

**PART I**

***TESTS – Follows are minimum required systems tests for verification of specification requirements.***

084 TRAILER

Trailer shall be weighed to determine net weight and distribution. The imposed loading on the lunette and axles shall be computed using the net weight and the rated payload. Calculated imposed loads on lunette and axles shall be used to ascertain the suspension axles and tires furnished are of adequate capacity to meet contract requirements and to determine conformance with this specification.

A road test shall be conducted to verify conformance with this specification. The road test shall consist of coupling the trailer loaded with the craft to a prime mover. The prime mover-trailer combination shall be driven a distance not less than 20 miles over paved roads. At least five sudden stops shall be made from a speed not less than 20 mile per hour. Brake performance must be verified to be in accordance with DoT Federal Motor Vehicle Safety Regulations, section 393.52. Tracking performance shall be observed and must be verified to be in accordance with DoT Federal Motor Vehicle Safety Regulations, section 393.70(a). After the test, the trailer shall be examined for evidence of misalignment, binding or other malfunction.

An electrical test shall be performed to determine that all trailer lights are in conformance with this specification.

The launch and retrieval of the craft from a boat ramp shall be performed. The craft shall be launched and retrieved successfully with no damage to the craft.

096 SCALE WEIGHING

Each craft and trailer shall be weighed prior to conducting Builders Trials. The craft shall be weighed in the light craft condition. The weighing shall be accomplished using a two point lift in order to determine the longitudinal center of gravity. If the LCG of any subsequent hull varies by more than  $\pm 0.7\%$  of the length between perpendiculars or if the weight of any subsequent hull varies from the weight of the first hull by more than five (5) percent, no additional construction shall be completed until the hull has been re-weighed, the cause of the weight variance has been determined and the designated Government representative's approval to continue has been obtained.

097 FLOTATION TEST

Conduct in accordance with ABYC standard H-8.

100 BUOYANCY FOAM QUALIFICATION

Prior to foaming the first craft, the Contractor shall submit the buoyancy foam qualification report verifying that the foam meets the requirements stated herein (see Section 070). The Contractor shall prepare two sample blocks of foam in fiberglass-reinforced plastic molds, with interior dimensions of not less than 400 by 400 millimeters, and not less than 600 millimeters in height. One sample block shall be prepared at the highest ambient temperature expected during the foaming process, and one at the lowest ambient temperature expected during the foaming process. Equipment, tools, materials and methods used shall be the same as those to be used in foam production. The foaming process and venting of the molds shall replicate the process to be used in the foaming of the craft. Foaming materials, manufacturer(s) and test lab identification shall be included in the qualification report. Sample preparation shall be performed by the Contractor and witnessed by the Designated Government representative. Each foam sample shall be tested as required herein. All trimming and cutting operations shall be accomplished without changing the cell structure of the cut surface. Wherever the term "sample" is used herein, it refers to each sample. Foam samples/specimens shall be retained for comparison with core samples.

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A  
***DRAFT***

Each mold shall be maintained at its ambient temperature for a minimum of 48 hours before the sample block is removed from mold. After removal from the mold, the molded sample shall be freed of all skin and shall be trimmed to provide plane surfaces, free of irregularities and foreign material.

- 5 Sample Density Testing -- The density of each sample (with skins removed and sample trimmed) shall be determined and reported in accordance with ASTM D 1622, except that standard deviation need not be calculated. The entire sample shall serve as the specimen.

- 10 Visible Characteristics Testing -- After successful completion of density testing, the sample shall be sliced, perpendicular to the direction of foam rise, into 25 millimeter thick layers. Both faces of each layer shall be examined visually to ensure that the sample meets the following requirements:

The foam shall contain no openings over 25 millimeters in diameter, no soft, tacky particles or accumulations of unexpanded resin.

- 15 The foam shall be composed of small cells of approximately the same size. The color of the foam shall be uniform throughout the sample.

Results of the Visible Characteristics Testing shall be reported.

- 20 Specimen Preparation for the Remaining Tests -- Specimens used for the remaining foam tests shall be selected at random from a quantity of specimens prepared for each test. The quantity of specimens shall be at least three times the number of specimens that are required for the test. The specimens shall be prepared from various layers throughout the sample. The actual specimens for the test shall be randomly selected and, the density of each specimen to be used in the test shall be determined in accordance with ASTM D 1622. In the event the density of a specimen varies by more than 25 10 percent from the sample density, that specimen shall be replaced by another randomly selected specimen until the required number of acceptable test specimens is obtained. The density of each specimen selected for testing shall be reported.

- 30 Compression Set Testing -- Three specimens, each  $57.30 \pm 0.03$  millimeters in diameter, 25 millimeters thick, shall be used for this test. Specimen thickness shall be measured to the nearest 0.03 millimeter. Each specimen shall be subjected to a static load of 0.35 kg/cm<sup>2</sup>, applied to the circular face, at 70(C for 24 hours. After application of the load, each specimen shall be allowed to recover, without external stress at 23(C for 30 minutes, then the thickness shall be remeasured. Compression set shall be calculated and reported as follows:

- 35 Compression set, percent =  $\{(t_o - t_1)/t_o\} \times 100$   
where  $t_o$  = thickness prior to test  
 $t_1$  = thickness after recovery

- 40 Water Absorption Testing -- Three specimens, each 100 millimeters by 100 millimeters by 25 millimeters thick shall be used for this test. The water absorption shall be determined and reported in accordance with ASTM D 2842, except the specimens shall be immersed under a 3 meter head of distilled water for at least 48 hours.

- Unicellularity Testing -- Unicellularity testing shall be conducted and reported in accordance with procedure B of ASTM D 2856.

- 45 Oil Resistance Testing -- Four specimens, each  $28.68 \pm 0.03$  millimeters in diameter shall be used for this test. Three specimens shall be immersed in No. 2 reference oil at 23(C in accordance with ASTM D 471. After 70 hours, the specimens shall be removed, lightly blotted and compared with a specimen which has not been immersed in oil. Results of the Oil Resistance Testing shall be reported.

50

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A

***DRAFT***

Humid Aging Testing, Part 1 -- Three specimens, 100 millimeters by 100 millimeters by 25 millimeters thick each, shall be tested for volume change after humidity aging as follows. The three specimens, along with three additional specimens shall be measured and subjected to testing in accordance with ASTM D 2126 (including report requirements) and the requirements herein, except that standard deviation need not be calculated. The additional specimens shall replace any of the specimens discarded because of warpage. Specimen dimensions shall be measured to the nearest 0.2 millimeter. The specimens shall be subjected to humidity aging for a period of at least 7 days. The temperature shall be 50(C and the relative humidity shall be 100 percent. While the humidity aging test is in progress, all specimens shall be measured and volumes calculated and recorded at the end of 1 day, 4 days and 7 days to assure that no reversion is present. NOTE: reversion is the progressive swelling and subsequent shrinkage of a specimen during testing.

At the conclusion of the 7 day humid aging period, the specimens shall be dried for 30 minutes at 60(C and then conditioned. The specimens shall be conditioned, without external stress, at 23(C and 50 percent relative humidity for not less than 24 hours.

Three specimens which meet the requirements for volume change shall be subjected to compressive strength testing as required herein.

Humid Aging Testing, Part 2 -- Five specimens, plus additional warpage replacement specimens as required, shall be subjected to humid aging, drying and conditioning as described in Part 1 of the humid aging testing. The five specimens shall be subjected to fire resistance testing as required herein.

Compressive Strength Testing -- Three specimens, 100 millimeters by 100 millimeters by 25 millimeters thick each, shall be tested for compressive strength in accordance with ASTM D 1621 (including report requirements), except that standard deviation need not be calculated. The specimens which meet the requirements for volume change after humid aging shall also be tested for compressive strength; the change in compressive strength shall be determined and reported.

Fire Resistance Testing -- Five specimens shall be used for this test. In addition, the specimens which were subjected to Part 2 of the humid aging testing shall be tested for fire resistance. Fire resistance testing shall be performed and reported in accordance with ASTM F 776.

**100 BUOYANCY FOAM TEST**

A buoyancy foam (core sample) test report shall be submitted for each craft, including the first. A minimum of 48 hours after installation of buoyancy foam, 50 millimeter diameter core samples shall be taken from four foamed-in-place locations on each craft. The core sample shall extend from the surface of the foam to the deepest point accessible in the compartment. Core samples shall be weighed to determine density. Where samples differ in appearance from test samples or contain large voids or appear brittle, physical characteristics shall be checked as specified in Buoyancy Foam Qualification. Additional samples shall be provided, as required. In the event the samples fail to meet the requirements, the affected foamed spaces shall be refoamed or otherwise corrected, as directed. Holes left by samples shall be filled with foam.

**300 ELECTRICAL TESTS**

The electrical system tests indicated shall be conducted in the order listed to demonstrate satisfactory system installation and operation. All tests, unless otherwise noted, shall be conducted on each boat built. Refer to IEEE Std 45-1998, Section 38 for additional guidance in performing these tests

**300 EQUIPMENT OPERATIONAL TESTS**

The operation of each load shall be tested by the operation of its respective switch on the control and distribution panel. All equipment shall be tested to verify proper operation in accordance with the manufacturer's specification.

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A  
***DRAFT***

**304 INSULATION RESISTANCE TEST**

The insulation resistance of each complete circuit shall be measured with an insulation resistance indicating instrument with the following characteristics: 0-100 Megohm range, 500 Vdc (nominal) source, constant voltage, push button or hand-driven generator type. Where the normal operating voltage of the circuit is less than 100 volts, a direct reading ohmmeter of the appropriate voltage should be used. Where circuits contain solid state devices, care should be exercised to ensure that the devices that have an operating voltage rating less than the test devices are disconnected or shorted out before the test voltage is applied. The test voltage for each circuit under test shall be applied no less than 30 seconds.

Each circuit shall have an insulation resistance between conductors and between each conductor and ground (shield, sheath, or armor) of not less than the following:

<b><u>LOAD</u></b>	<b><u>RESISTANCE</u></b>
Up to 5 Amperes	2 Megohms
Up to 10 Amperes	1 Megohm
Up to 25 Amperes	400 Kilohms
Up to 50 Amperes	250 Kilohms
Over 50 Amperes	100 Kilohms

Any or all loads connected to the circuit may be disconnected if such action is necessary in order to obtain the desired insulation resistance.

**310 STARTER-ALTERNATOR TEST**

In conjunction with a pretrial test of the propulsion engine, the engine starting system shall be operated to determine that it is functioning properly. With the engine running, the alternator and voltage regulator operation shall be inspected to ensure that the proper adjustments have been made as specified by the manufacturer to ensure optimum operation of the electrical system and correct charging of the craft batteries. For the first boat only, with the propulsion engine running at maximum engine operating rpm, the rpm of the alternator shall be measured to ensure that its maximum design rpm is not exceeded.

**313 STORAGE BATTERY AND BATTERY CHARGER TEST**

Batteries shall be inspected to determine that the proper batteries have been installed for their required functions, and that the batteries have been charged. The battery charging capability, including adequacy of the cable lengths and connectors, shall be demonstrated. The tests shall demonstrate that the battery charger is capable of delivering its rated output and that it will charge the batteries and maintain them in a fully charged condition without overcharging. The tests shall be conducted in accordance with the manufacturer's recommendations.

An insulation-resistance test shall be performed on each battery charger.

Each battery charger shall be tested to demonstrate delivery of rated output.

Each battery disconnect switch shall be actuated to insure correct operation.

All battery banks and associated circuitry/equipment shall be tested for proper installation and operation.

**313 BATTERY CHARGING RECTIFIER TEST**

Each battery charging rectifier shall be tested to verify proper operation in accordance with the manufacturer's

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A  
***DRAFT***

recommendations.

320 ELECTRIC POWER AND DISTRIBUTION SYSTEM TEST

- 5 Proper voltage and polarity of each circuit and proper distribution throughout each craft's electrical power distribution system shall be demonstrated. Each load shall be tested to confirm correct operation of the load, circuit protection device(s), switches, other controls and devices.

- 10 Each D.C. and A.C. power circuit and load shall be checked for the following: measured and specified voltage and current, circuit breaker rating, cable size and designation and accuracy of cable tags. Receptacles should be checked for the circuit designation, and measured and specified voltage.

320 VOLTAGE DROP TEST (FIRST BOAT ONLY)

- 15 During or after the above operational test, the voltage drop between the distribution bus and each load, with the associated equipment energized, shall be measured. Voltage drop in circuits for bilge blowers, electronic equipment, navigation lights and other circuits where voltage drop must be kept to a minimum, shall not exceed 3%. Lighting and other circuits where the voltage drop is not critical shall not exceed 10%. If the voltage drop exceeds the requirements, the condition shall be corrected and re-tested.

20

400 GENERAL TESTING REQUIREMENTS FOR ELECTRONICS

- 25 Electronic equipment shall not be energized until satisfactory completion of the insulation resistance test of the craft service system, the specific equipment interlock circuits verified for specified operation, and all external metal parts of electronics equipment are at ground potential and resistance to ground recorded.

All electronic equipment listed in the 400 section of the specification shall be demonstrated to verify operation in conformance with the specific equipment manufacturer's specifications.

- 30 422 NAVIGATIONAL LIGHT TEST -- The navigational light installation shall be inspected to ensure that the lights are located properly and the arcs of visibility conform to the requirements of the International Regulations for Preventing Collision at Sea, 1972 (72 COLREGS) and any subsequent amendments to the 72 COLREGS.

504 INSTRUMENTS, INDICATORS AND ALARMS

35

Instruments and indicators shall be observed for proper operation. Where an indicator is intended to signal an abnormal condition, the sensor shall be artificially excited to demonstrate proper operation. Instrument and indicator operation and method of artificial excitation, where applicable, shall be recorded.

- 40 582 MOORING FITTING TEST

All cleats, chocks, and bitts on each craft shall be tested to 50% of the rated breaking strength of the mooring line. The load shall be applied in a plane perpendicular to the craft centerline.

- 45 582 TOWING FITTING TEST

A line pull of 150 percent of the design load shall be applied to the towing fittings, over the range of directions and locations which can be expected in towing. The items tested and their foundations shall have their welds tested after the above tests by a non destructive test method. Flaws shall be corrected and the joint retested.

50

***DRAFT***

610 LIFTING FITTING TEST

For each craft (cradle and/or trailer) all lifting fittings and equipment shall be tested to 150% of the calculated load. Welding of hoisting fittings shall be nondestructive tested before and after load testing.

5

All hoisting slings shall be tested to two hundred (200) per cent of the applicable hoisting load for a period of no less than ten (10) minutes with no failure or permanent deformation.

633 CATHODIC PROTECTION

10

A test shall be conducted on the first craft to verify the satisfactory performance of the cathodic protection system. The test shall demonstrate that the cathodic protection system is capable of inducing and maintaining a minimum negative shift of 200 millivolts in the potential of the composite cathode relative to a silver-silver chloride half-cell.

15

700 WEAPON MOUNT LOAD TEST

A static load test shall be conducted on the aft weapon mounts and their supporting structure. A load of 1500 pounds, acting through the center of the barrel, shall be applied in each of three directions; through the center of the arc of train and at the left and right limits of train. The load shall be held for ten minutes in each direction. The weapon mount and its supporting structure shall exhibit no evidence of structural failure or permanent deformation.

20

PERFORMANCE SPECIFICATION – SMALL UNIT RIVERINE CRAFT APPENDIX A  
***DRAFT***

***FOR INPUT INTO THE CONTRACT DATA REQUIREMENTS LIST (CDRL)***

5

***Test procedures.-*** Test procedures shall provide the detailed description of the operations to be performed and the parameters to be measured during the conduct of each test or trial and the pass/fail criteria. Instructions for analysis of raw data shall be provided. Each test procedure shall include procedures required for safety of personnel and equipment. Each test procedure shall contain data sheets which provide spaces for recording the quantitative values determined during the test. Data sheets shall also provide space for recording results of analysis of raw data taken during the test. Each data sheet shall show specified values and tolerance limits for each measured value. Each data sheet shall have a space for recording a test conductor signature, a Government witness signature and test date. Where specified, test procedures shall contain Government data recording forms. Block diagrams, simplified schematics or diagrammatics may be used to clarify the procedure or simplify the test method. Comment sheets shall also be included to record significant events and observations which occur during conduct of the test by either the Government witness or the test conductor.

10

15

20

25

***Test and trial reports.-*** Test reports shall document the overall test or trial results and findings in relation to technical specification requirements. The test reports shall include the test procedure with completed data sheets, and results of analysis of the raw data records taken at the time of test. All performance data shall be provided in tabular form or plotted on graphs as applicable. The Contractor shall prepare a test report for each test conducted during the test program. Test reports shall be numbered with the craft registry number followed by the number for the test. Test reports should further be identified to reflect those tests which are a verification of system design and therefore require accomplishment on only the first craft, or any subsequent craft with design differences, and those which are a verification of installation or construction quality and adequacy and, therefore, must be performed on each craft. A separate test report is required for each test for each craft. Consolidating test results for multiple craft is not acceptable. The Contractor shall assemble all test and trial reports for each craft into a booklet of test reports for installation on each craft prior to delivery.